The Giovanni News
February 2014
GODDARD EARTH SCIENCES DATA & INFORMATION SERVICES CENTER (GES DISC)

From the Editors

There's a saying, "Everybody talks about the weather, but nobody does anything about it" (or something similar). This winter, a lot of people have been talking about the weather and, perhaps, wishing that something could be done about it, especially when they are shoveling more snow. Here in Maryland, we've had a few days when Goddard Space Flight Center has either opened late or not opened at all, due to snow, ice, or the dreaded and somewhat undefined "wintry mix."

Although the Giovanni data system doesn't have what is properly called "real time data," we do receive data products on a timely basis, some of them within hours after they were acquired by the satellite. This means that we can look at weather events fairly soon after they've happened. So, rather than just talking about the weather, we can talk about it with more information, such as that provided by the Tropical Rainfall Measuring Mission (TRMM) and the Atmospheric Infrared Sounder (AIRS).

Giovanni's capabilities are utilized much more frequently by researchers looking at past events, especially past months and years and seasons. Development of Giovanni-4 is proceeding rapidly, and one of the new and very exciting capabilities of the system is the creation of time-series plots for specific months or seasons. Now, if anyone is wondering how the temperature of this January compares to previous Januaries, or how the rain last spring compares to previous springs, Giovanni-4 will soon make that possible. This particular capability is being beta-tested, so it won't be long until it is available to everyone, along with more and more data sets that are being migrated to Giovanni -4. You can see an example later in this issue.

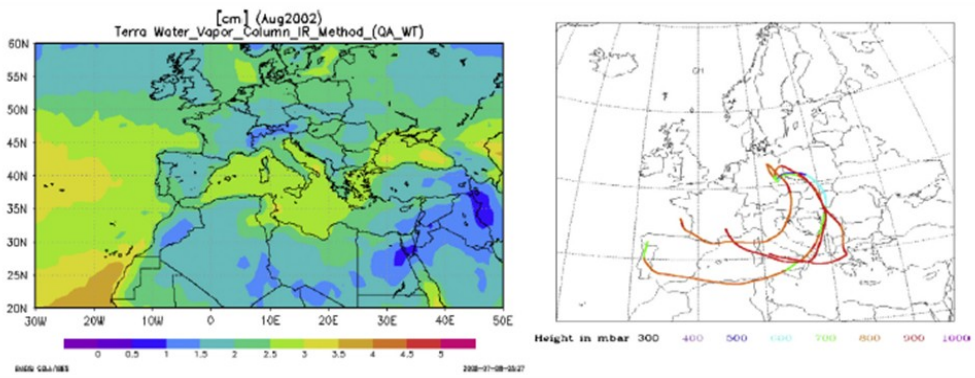
Giovanni-3 is still available and will be available until Giovanni-4 is fully implemented. Scientists are still using "G3," as evidenced by the increasing number of publications citing the system. In 2013, a total of 214 such papers published in peer-reviewed journals were counted, a new "record," which is also summarized here. While those numbers are impressive, it's the science being done with the system that really counts.

As we go to press, we've received some very exciting news about a very useful expansion of Giovanni. More on that next month. (and as soon as possible). Finally, the papers just keep on coming; the featured paper from January is about the weather, specifically extreme hydrometeorological events in Europe and how they might be related to climate change.

Welcome to 2014!

Jim Acker and Wainie Youn

Research Highlight: Hot, Humid, and Polluted Air Can Cause Heavy Rain in Europe



Are heavy rain events happening more frequently in Europe due to climate change? Or, in some regions, are they actually happening less frequently? That's the question that Millán M. Millán examined in a paper that is in press (but already available online) for the Journal of Hydrology. Millán examined field meteorological data from 1974-2011 to address the question. The result was a description of a remarkable mechanism that involves land use change along the coast and on the slopes of mountains, recurring accumulation of water vapor and tropospheric ozone in the atmosphere, and salinity of the Atlantic Ocean and Mediterranean Sea near the Strait of Gibraltar. One effect of this mechanism is to alter the tracks of Atlantic Ocean depressions and weather fronts.

The above brief description is a very short (and likely too succinct) summary of the 19-page paper, "Extreme hydrometeorological events and climate change predictions in Europe." Ultimately, Millán listed several questions raised by his examination and indicated that the question is still out regarding these extreme events and climate change.

One aspect of the interconnected mechanism described in this paper is the accumulation mode, in which tropospheric ozone generated by air pollution becomes layered with water vapor over the Mediterranean Sea up to a considerable altitude. Eventually, the layers transport water vapor over central Europe, which can result in heavy rainfall events. Giovanni was used with the MODIS water vapor product to investigate this part of the mechanism, showing where the atmospheric water vapor was persistently elevated. As the author said, "…the mechanisms described in the text are able, in just a few days, to generate a very large, deep and polluted air mass that increases both in moisture content and in potential instability with each passing day." One such event occurred in August 2002, when the water vapor moved to Germany and the Czech Republic, feeding heavy flood-inducing rains that occurred mid-month. The following image shows the monthly water vapor data product (left), where elevated water vapor concentrations are visible over the western Mediterranean basin. The trajectories of the storms that delivered the rainfall into central Europe, supplied by water vapor from the summer Mediterranean atmosphere, are shown at right.

In this Issue

New additions to Giovanni publications list, September-December 2013

Giovanni was reported used in more than 200 peer-reviewed citations in 2013

An end-of-year compilation of scientific research publications of studies that used the NASA Giovanni (**G**eospatial **I**nteractive **O**nline **V**isualization **AN**d a**N**alysis **I**nfrastructure) system garnered 81 new entries for the 2013 list. These additions brought the total for the year to 214, substantially exceeding the 185 counted in 2012. The total number of peer-reviewed publications since 2003 now stands at 859. In addition to the peer-reviewed category, which represents the highest level of scientific discourse, Giovanni has also been reported being used in many other types of communications, such as Ph.D. dissertations, Masters theses, government agency reports, papers published with meeting proceedings, and both talks and posters presented at scientific meetings.

One of the interesting papers published during this period was authored by Yangyang Xu & Ranjit Bahadur of Scripps Institution of Oceanography in La Jolla, California and Chun Zhao & L. Ruby Leung of the Atmospheric Science and Global Change Division, Pacific Northwest National Laboratory in Richland, Washington. The paper is entitled "Estimating the radiative forcing of carbonaceous aerosols over California based on satellite and ground observations" and was published in the Journal of Geophysical Research: Atmospheres. The smog in Los Angeles is (in)famous, but these researchers looked at how aerosols containing carbon affected both incoming solar radiation directly, and indirectly by influencing the formation of clouds and precipitation, over the entire state. For the decade of 2000-2010, the radiative effects of these carbonaceous aerosols were considerably greater than the effects from natural dust. Elemental carbon (EC), also called "black carbon," had the greatest influence. Fortunately, California's efforts to reduce EC over the past twenty years have brightened the skies over the Golden State, particularly over southern California.

Giovanni was used in this research to access outputs from the GOCART (Goddard Chemistry Aerosol Radiation and Transport) model. The researchers also used data from the Multi-Angle Imaging Spectroradiometer (MISR) and from AERONET.

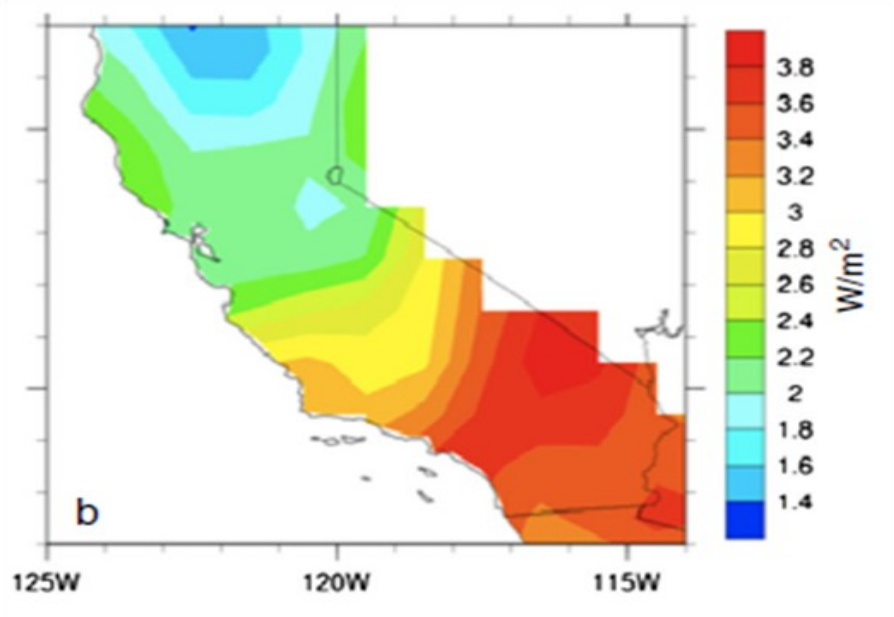


Figure from Xu et al. (2013), showing surface brightening over California (expressed in units of Watts per square meter) during the past two decades.

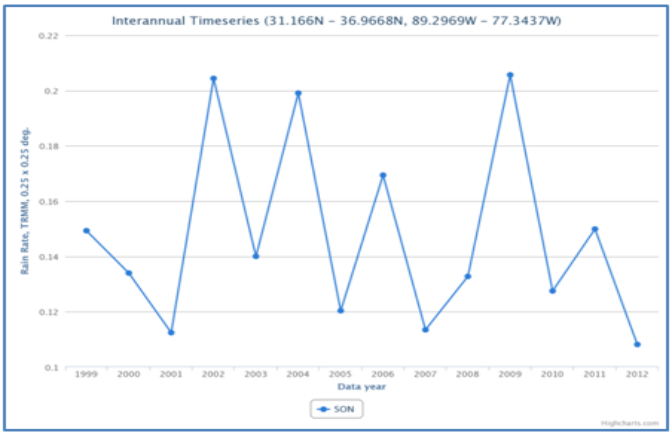
Giovanni-4 Development Update

As the Editor's Note indicated, one exciting new capability of Giovanni-4 will be the generation of seasonal or monthly time-series plots. This capability is still in beta test mode but is nearing operational release.

The image here provides an example of this capability. The data product used was the Tropical Rainfall Measuring Mission (TRMM) Rain Rate, at 0.25 degree resolution. The area of interest was the southeastern United States, and the season of interest was autumn (September-October-November, or SON). In this region and season, most of the rainfall is generated by landfalling tropical storm systems, which can be highly variable from year to year. The seasonal time-series demonstrates the considerable variability of rain over the region from 1999 to 2012. Surprisingly, the "Year of the Hurricane," 2005, which included both Hurricanes Katrina and Rita, appears as a low point in the plot. This could be because Katrina's effects were primarily felt in August, and Rita moved inland over Texas, which is at the edge of the area defined for the plot.

There will likely be numerous research uses for (and likely many surprises generated by) this new Giovani-4 capability, which is one that members of the user community have repeatedly expressed interest in adding to the system. Now that it will soon be available in Giovanni-4, we'll just sit back and wait for the research results to show up at meetings and in journals.

Another capability currently in beta testing allows user to generate "quasi-climatologies." The quasi-climatology averages values for a given month (or three-month season) over a user-specified range of years at each grid cell in a specific area of interest. Because most satellite data records are little more than a decade long, it wouldn't be proper to call these actual climatologies, which generally span at least two decades and preferably three or more. The current anomaly analysis in Giovanni uses pre-defined climatologies provided by instrument or research teams. Eventually, Giovanni-4 may add the capability to generate anomalies using the quasi-climatologies, but that lies in the developmental future.



Now can the winter of our discontent be most timely researched with Giovanni and NASA data